

# Suicide trends in Canada, 1956-1981

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**ABSTRACT** - Using official suicide statistics, this study examined suicide rates in Canada over a 25-year span (1956 to 1981) as a function of age, gender, and geographical region. The analysis revealed that, for both sexes, the risk of suicide among the 15-24 year-olds increased at a faster rate than in any other age group. Male and female age-standardized suicide rates demonstrated an overall increase between 1956 and 1981. The trend for males was one of continuous increase, whereas female rates reached a maximum in 1976 and then decreased. Regional differences in suicide rates were also apparent. Although not strictly observed, a trend toward increasing risk of suicide in males as one proceeds westward across Canada was found. For females, a pattern of increasing suicide with more westerly location was also found, except that Ontario and the Prairie Provinces were in reverse order. Several possible explanations for these findings are presented.

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The increasing rate of suicide is of growing concern to mental health professionals, governments and the public. Not only have deaths due to suicide increased as a proportion of all deaths (1), but suicide rates have also been steadily climbing (2). While it has been generally accepted that rates of suicide increase directly with age (3-6), more recently investigators have observed a shift in the age-related pattern of suicide rates. Specifically, Diekstra (7) found that in the Netherlands from 1950 through 1978, suicide rates increased for all age groups below 50 years, while they remained stable during the same period of time for those aged 50 years and over. Examining the changing profile of suicides in the province of Alberta, Canada, Hellon & Solomon (8) observed that suicide rates increased more in the younger than in the older age groups during the years 1951 through 1976.

Several investigators have found that the relationship between age and changes in suicide rate depends on gender (8-10). For example, Frederick (9) found that suicide rates increased for both young males and females, but the increase for

males was greater. McIntosh & Jewell (11), in examining sex-related trends in suicide rates, found that the ratio of male to female suicides over time increased for the young and declined for the old.

Previous research has separately examined suicide rate patterns as a function of time (2, 12) or specific geographical location (8, 13, 14). It is important, however, to examine together the variation of suicide rates over time for specific groups residing in different geographical regions (2, 15). Thus, the purpose of the present investigation was to determine the Canadian trends in suicide rates as a function of gender, age, region and time.

## Methods

### Data

Suicide and population data were provided on computer tape by Health and Welfare Canada. For present purposes, deaths coded in the range E950-959 of the International Classification of Diseases - ninth revision (ICD-9), or the corresponding codes of earlier revisions, were classified as suicides.

Questions regarding the reliability of official suicide statistics have often been raised (16-18) due to definition and reporting problems. However, evidence has been reported that indicates that no systematic bias exists in such data (19, 20) so that valid comparisons can be made between demographic groups, between geographical areas, and over time.

In order to minimize random variation due to year-to-year fluctuations, the number of suicides occurring during each of the 3-year periods centered on the census years (1956, 1961, 1966, 1971, 1976, 1981) were averaged, and rates were calculated using census-year population counts as the denominator.

Throughout the analysis 10-year age groupings were adopted, starting at age 15 with the final age group being 65+. Since suicide is uncommon before age 15, the youngest ages were excluded. Canada consists of 10 provinces and 2 territories, which vary greatly in population size. Frequently, the provinces are grouped into the following geographic regions: Atlantic provinces (Newfoundland, Nova Scotia, Prince Edward Island, New Brunswick), Quebec, Ontario, Prairie provinces (Manitoba, Saskatchewan, Alberta) and British Columbia. In the order presented, the 5 regions run from east to west, except that a sparsely populated area of Quebec lies north of the Atlantic provinces. In 1981 the populations of the regions ranged from a low of 2.2 million in the Atlantic provinces to a high of 8.6 million in Ontario. Due to their small population size (0.3% of the total Canadian population in 1981), the Territories (Yukon and Northwest Territories) were excluded from any analysis in which geographic regions were being considered. When Canada was examined as a whole, the Territories were included, although their contribution to the overall picture was negligible.

## Statistical methods

The data analysis was conducted in two stages. First, we performed a series of exploratory univariate analyses in which age, gender and region-specific suicide rates were examined over the period 1956 to 1981. In order to adjust for the potential confounding effects of a changing age

distribution, we computed age-standardized suicide rates, using the total population of Canada in 1981 over age 15 as the standard population.

Because the descriptive approach is limited in that it is unable to determine whether observed patterns and trends are due to random variation or not, a statistical model is required. The second stage of the analysis utilized a multivariate statistical method akin to multiple regression, the Poisson regression model (21). This model assumes that the number of suicides is distributed as a Poisson random variable, which is reasonable since suicide is a relatively rare occurrence. Because of the logarithmic transformation, the model is a multiplicative one. This is also appropriate since suicide rates are usually compared using ratios of rates. The explanatory variables (age, gender, year and geographic region) were treated as categorical variables, and models were developed using a hierarchical procedure (22). That is, terms were added to an existing model provided terms of lower order were already part of the model. The likelihood ratio test was used to determine statistical significance at each stage. In order to perform the Poisson regression analysis, the GLIM (23) software package was used.

## Results

### Suicide rates by gender

The age-standardized suicide rates for males and females in Canada are shown in Table 1 (see also

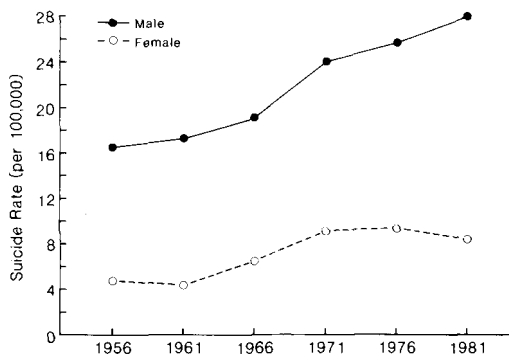


Fig. 1. Age-standardized suicide rates per 100,000 population for Canada, 1956-1981.

Table 1  
Age-standardized<sup>a</sup> suicide rates for males and females and male : female rate ratios in Canada, 1956-1981

Year	Rate (per 100,000)		Ratio
	Male	Female	
1956	16.5	4.8	3.4
1961	17.3	4.4	4.0
1966	19.2	6.6	2.9
1971	24.1	9.2	2.6
1976	25.7	9.4	2.7
1981	28.0	8.4	3.3

<sup>a</sup>Standardized to 1981 total Canadian population over age 15.

Fig. 1). The male rate climbed steadily during the time period under consideration, increasing by 70%, from 16.5 (per 100,000) in 1956 to 28.0 in 1981. The pattern for females was somewhat variable, but overall there was a 75% increase in the rate, rising from 4.8 (per 100,000) in 1956 to 8.4 in 1981.

The suicide rate for males was consistently greater than that for females for each year from 1956 to 1981. In Table 1 the ratios of the male-to-female rates are given. During 1971 to 1981 the ratios increased, indicating a widening differential between male and female suicide rates during the last decade of the study period.

An important question is whether the apparent

trends are real or are simply caused by changes in the way underlying causes of death have been recorded. The ICD-8 (which was used in Canada during the period 1969-1978) and the ICD-9 both contain the category "Injury undetermined whether accidentally or purposely inflicted". (The rubrics are E980-989 in both classification schemes). This category of causes seems the most likely source of confusion with suicides. For the years 1971, 1976 and 1981, male suicides represented 92%, 84% and 86%, respectively, of the deaths registered in both categories combined. The corresponding results for females are 85%, 80% and 79%. These trends suggest that the decrease in female suicide rates could have been partly caused by a change in cause of death recording, but that it is not likely that this factor caused the increase in male suicide rates during 1971-1981.

### Suicide rates by age

Age-specific suicide rates for males are shown in Table 2 (see also Fig. 2); the corresponding results for females are given in Table 3 (see also Fig. 3). Reading across the rows of Table 2, we find that between 1956 and 1971 the risk of suicide in males increased with age to a maximum in the 55-64 age group, followed by a

Table 2  
Age-specific suicide rates<sup>a</sup> and rate ratios (relative to 1956), for males in Canada, 1956-1981

Year	Age group					
	15-24		25-34		35-44	
	Rate	(Ratio)	Rate	(Ratio)	Rate	(Ratio)
1956	5.5	(1.0)	11.5	(1.0)	15.5	(1.0)
1961	7.5	(1.4)	13.4	(1.2)	16.9	(1.1)
1966	10.5	(1.9)	15.9	(1.4)	19.4	(1.3)
1971	18.1	(3.3)	21.4	(1.9)	26.5	(1.7)
1976	24.7	(4.5)	25.0	(2.2)	25.6	(1.7)
1981	26.3	(4.8)	28.7	(2.5)	25.6	(1.7)
Year	45-54		55-64		65+	
	Rate	(Ratio)	Rate	(Ratio)	Rate	(Ratio)
	1956	23.0	(1.0)	31.4	(1.0)	28.3
1961	24.9	(1.1)	29.5	(0.9)	25.2	(0.9)
1966	25.5	(1.1)	30.0	(1.0)	25.2	(0.9)
1971	29.9	(1.3)	30.8	(1.0)	25.1	(0.9)
1976	29.4	(1.3)	26.4	(0.8)	24.8	(0.9)
1981	30.1	(1.3)	29.1	(0.9)	29.8	(1.1)

<sup>a</sup> Per 100,000 individuals.

Table 3  
Age-specific suicide rates<sup>a</sup> and rate ratios (relative to 1956), for females in Canada, 1956-1981

Year	Age group					
	15-24		25-34		35-44	
	Rate	(Ratio)	Rate	(Ratio)	Rate	(Ratio)
1956	1.4	(1.0)	4.3	(1.0)	5.2	(1.0)
1961	1.8	(1.3)	4.0	(0.9)	4.5	(0.9)
1966	2.4	(1.7)	6.1	(1.4)	8.4	(1.6)
1971	4.7	(3.5)	9.0	(2.1)	11.9	(2.3)
1976	6.0	(4.5)	9.0	(2.1)	11.3	(2.2)
1981	5.0	(3.7)	8.0	(1.8)	9.7	(1.9)

Year	45-54		55-64		65+	
	Rate	(Ratio)	Rate	(Ratio)	Rate	(Ratio)
	1956	8.4	(1.0)	8.2	(1.0)	5.3
1961	7.2	(0.9)	6.7	(0.8)	5.0	(0.9)
1966	10.2	(1.2)	10.6	(1.3)	5.8	(1.1)
1971	14.0	(1.7)	11.6	(1.4)	7.6	(1.4)
1976	13.5	(1.6)	11.9	(1.5)	7.7	(1.4)
1981	12.3	(1.5)	11.4	(1.4)	7.9	(1.5)

<sup>a</sup> Per 100,000 individuals.

decline to the 65+ rate. For the period 1976-1981 the maximum was reached somewhat earlier in the life cycle (the 45-54 age group). A similar analysis of Table 3 demonstrates that, with the exception of 1966, for each of the years investigated, female rates increased with age until the 45-54 age group, and then declined.

Figs. 2 and 3 show that the male and female age-specific suicide rates underwent quite different evolutions during 1956 to 1981. For males (Fig. 2), except for the 65+ age group, the curves remained more or less parallel until 1966, at which point they began to converge. By 1981,

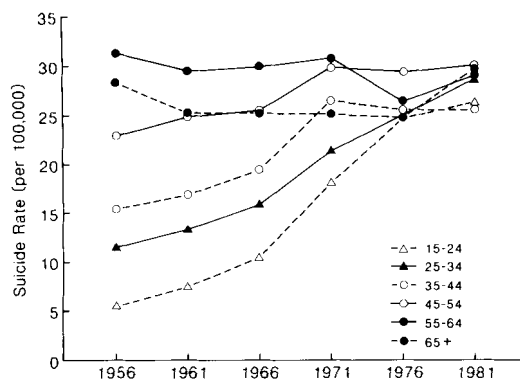


Fig. 2. Age-specific suicide rates per 100,000 population by age group for males in Canada, 1956-1981.

all age-specific rates fell within the range 25.6 to 30.1 (per 100,000), as compared to the range 5.5 to 31.4 in 1956 (Table 2). The rates for the 55+ age groups generally remained stable, while those for the 15-54 year olds increased, resulting in the observed convergence.

For females (Fig. 3), the curves for the 15-54 year olds were largely parallel during 1956 to 1981. The curves for the 55+ groups were also parallel, but showed less of a tendency to increase compared to the younger age groups. Female rates did not show the same tendency to converge that the male rates did (Table 3).

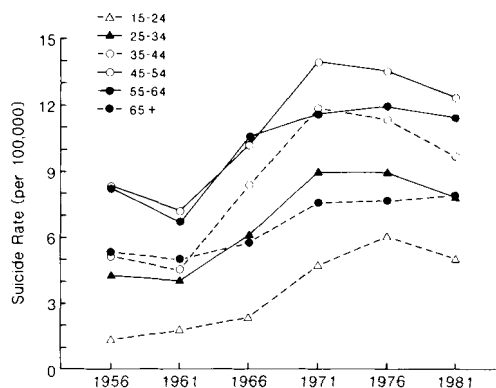


Fig. 3. Age-specific suicide rates per 100,000 population by age group for females in Canada, 1956-1981.

Tables 2 and 3 include the ratios of age-specific suicide rates relative to the 1956 rate (by definition the 1956 ratios are equal to one). For males (Table 2), the ratios for the 55-64 and 65+ age groups were close to one, indicating stability of suicide rates during 1956-1981. For the ages groups in the 15-54 range the ratios demonstrated a consistent pattern of increase, with the ratios for the younger age groups greater than those of the older age groups. In particular, the ratios for the 15-24 year-olds were consistently greater than those for any other age group for each of the years considered. By 1981 the suicide rate for those between 15 and 24 years of age had climbed to 4.8 times the 1956 rate.

For females (Table 3), the ratios demonstrated an overall increase during 1956 to 1981 in each of the age groups. For the 15-64 year-olds the ratios

climbed to a maximum in 1971 or 1976 and then declined, whereas for the 65+ age group no such decrease was observed. The rate of change in the ratios over time was more pronounced in the younger age groups. The ratios for the 15-24 year-olds were consistently larger than those for any other age group for each of the years considered.

Sex ratios (male:female) of suicide rates over time were examined for each age group. As shown in Fig. 4, between 1956 and 1981 sex ratios increased for the 15-24 and 25-34 age groups, whereas declining sex ratios of suicide rates were observed for the 35+ age groups. Note that all age groups except the 55-64 year-olds showed an increase in sex ratio after 1971. These age-specific increases combined to produce the overall sex ratio increase observed in Fig. 1. Examining Figs. 2 and 3, it can be seen that the increase since 1971 is largely due to increasing or plateaued suicide rates for males and declining rates for females.

Figs. 5 and 6 show the age-standardized suicide rates by geographic region for males and females, respectively. Except for Quebec, which demonstrated a uniquely rapid increase in the rate of suicide during 1966 to 1981, the male suicide rates (Fig. 5) underwent similar changes across regions during the time period under consideration. Although not strictly observed, there is certainly a trend toward increasing risk of suicide in males as one proceeds westward. Female suicide rates (Fig. 6) demonstrated a

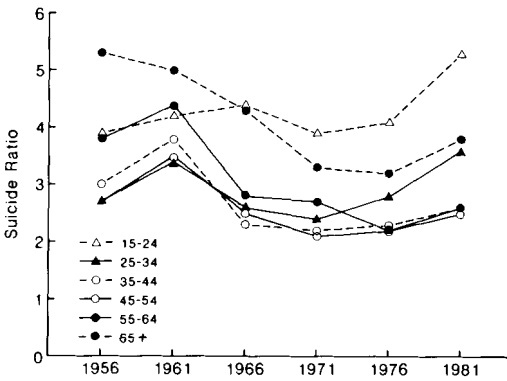


Fig. 4. Ratio of male-to-female suicide rates by age group in Canada, 1956-1981.

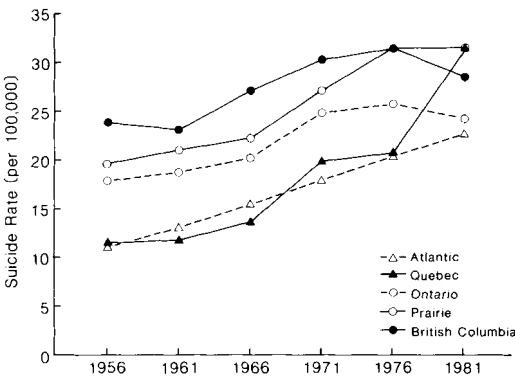


Fig. 5. Age-standardized suicide rates per 100,000 population by geographical region for males in Canada, 1956-1981.

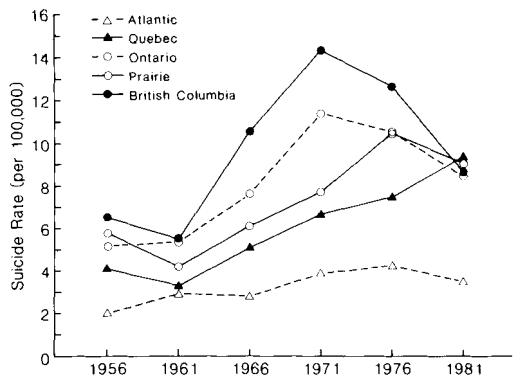


Fig. 6. Age-standardized suicide rates per 100,000 population by geographical region for females in Canada, 1956-1981.

Table 4  
Chi-square tests of significance of terms for selected Poisson regression models

Model number	Model description <sup>a</sup>	$\chi^2$ <sup>b</sup>	Degrees of freedom <sup>c</sup>	<i>P</i>
1	Gender	10,362	1	< 0.001
2	Age	1,869	5	< 0.001
3	Year	1,674	5	< 0.001
4	Region	1,017	4	< 0.001
5	Gender . year	114	5	< 0.001
6	Age . year	1,050	25	< 0.001
7	Age . gender	348	5	< 0.001
8	Region . year	486	20	< 0.001

<sup>a</sup> Each model includes the term in that row plus all terms in earlier models.

<sup>b</sup> Likelihood ratio test for significance of term in that row given all terms in earlier models included.

<sup>c</sup> Degrees of freedom for term in that row.

tendency to diverge during 1961 to 1976, but by 1981 the regions (excluding the Atlantic provinces) showed an even greater tendency to converge. A pattern of increasing suicide risk with more westerly location is apparent, except that Ontario and the Prairie provinces are in reverse order.

### Poisson regression model

The preceding descriptive analysis identified a number of apparent trends in suicide rates. However, because of random variation, observed trends may be due to chance phenomena. To guard against this possibility, Poisson regression models were fitted to the data.

The results of this analysis are summarized in Table 4. Each model includes the term in that row plus all terms in earlier models. So model 1 only has a term for gender, model 2 has terms for gender and age, etc. The dots in models 5 to 8 represent interaction terms. The chi-square value for a given row corresponds to a test of significance of the term appearing in the row conditional upon all earlier terms being in the model. For example, testing "year" for statistical significance given that gender and age are in the model resulted in  $\chi^2 = 1,674$  with 5 degrees of freedom (model 3). Entering terms into the model in a different order resulted in different chi-square values, as expected, but did not change the levels of significance observed.

Each of the terms appearing in Table 4 is

highly statistically significant, and gives validity to observations made during the earlier descriptive analysis. Although not included in the Table, the regression coefficients in all instances were consistent with observations made earlier in connection with the univariate analyses. Models 1 to 4 show that suicide rates vary by gender, age, year and region. From model 5 it follows that male and female rates demonstrated different patterns during 1956–1981, as observed in connection with Fig. 1. Models 6 and 7 show that age-specific suicide rates varied during 1956–1981 and the picture was different for males and females. This pattern was noted in connection with Figs. 2, 3 and 4. Model 8 demonstrates that regional suicide rates changed during 1956 to 1981, a finding observed in Figs. 5 and 6.

We would have liked to have added further terms to the model (in particular, such three-way interaction terms as age, year, gender), in order to determine whether age-specific suicide rates varied differently over time for males and females. However, this was not possible because of technical difficulties. GLIM is a software package designed for small data set analysis, and the addition of further terms to model 8 exceeded the limits of data storage. However, a chi-square goodness-of-fit for model 8 ( $\chi^2 = 861$ , *df* = 289) indicates that additional statistically significant terms could have been added to the model, suggesting that the three-way interactions we wished to consider might have explanatory value.

## Discussion

Suicide rates in Canada were analyzed as a function of age, gender, time and geographical region. In line with previous research (8, 24, 25) youth suicide was found to have increased substantially over time. Specifically, for both males and females, suicide among the younger age groups increased at a faster rate than among all other age groups considered. This finding may reflect the impact of the number of social problems and the concomitant stress faced by young persons in recent times (26). According to Diekstra & Kerkhof (27), young persons are affected by social problems to a greater extent than are older people. Thus, to deal with chronic family conflict, difficulties in interpersonal relationships, feelings of uselessness, and abuse of alcohol and drugs within a personal context of low self-esteem, lack of a sense of identity, and fewer personal and social resources, the young person may see death as one of the means to escape the hopelessness and pain. With societal attitudes toward suicide changing in the direction of greater acceptance (28) young people may give suicide a higher priority among the many possible solutions to their problems. What underlies the apparent greater vulnerability of young people to the increased number of social stresses and their choice of suicide as a possible solution is a matter for conjecture and thorough investigation.

Similar to the trend in the United States (11), male suicide rates in Canada have continued to climb, whereas female rates have begun to decline in recent times. It is beyond the scope of this study to empirically investigate the reasons underlying these trends, although several explanations can be offered. Baechler (29) has suggested that suicidal behavior is characteristic of individuals or groups that depend upon more powerful others for their well-being. That is, persons who feel powerless, incompetent, and worthless may engage in suicidal behavior in order to either escape from life altogether or to obtain a response that will satisfy such necessary psychological needs as affection, security and significance (30). As women increase their participation in the work force, more positive effects

on the coping abilities and resources of women may result (31, 32). Indeed, work-force participation for women in Canada has approximately doubled since 1956 (from 25% in 1956 to 62% in 1981). As women become more involved in the work force, such personal benefits as financial independence, self-reliance, competence, self-worth and power may occur. According to Baechler (29), these and other factors could potentially reduce the suicide rate among women, as was found in the present study.

However, Davis (33) found that female participation in the work force was associated with increased female suicide rates. While on the surface the current findings are in conflict with those of Davis, it may well be a function of the context or time period. That is, in both studies, female suicide rates increased during the 1960's. At this time the women's movement was gaining momentum and many women may have felt increasing conflict between their traditional role as housewife and their job outside the home, resulting in suicide rate increases (33). During the 1970's and early 1980's, female work-force participation may have become more acceptable or normative, thereby reducing the conflict and associated stress experienced in the 1960's and reducing the rates of female suicide.

Increased participation of women in the work force may also partially explain the continued increase in male suicides. Specifically, the changing sex roles, the greater competition for jobs and unemployment may increase the level of stress for men and decrease their sense of power and status and hence their self esteem. Such factors could indeed increase the likelihood of suicide among men.

McIntosh & Jewell (11) suggested several other explanations for findings in the United States that are similar to those in the present study. First, they suggested that the decline in female suicide rates may be due to the increased utilization of suicide prevention centres by women (34). Second, McIntosh & Jewell (11) argued that since women (in comparison to men) tend to use less lethal methods, such as drug overdoses, and since medical technology for the treatment of drug overdose and self-poisoning has improved greatly, women are more likely to be rescued

following an attempt. On the other hand, since it has recently been found that men attempt suicide more often (32), and since they tend to use more lethal methods in their attempts (35), the probability of completed suicides would be expected to increase.

Regional differences in suicide rates were found in the present study. Not only were the rates greater in the west than in the east, but this pattern remained relatively consistent over each time period except 1981. Since a variety of social problems are linked to suicide, and since the rates of such social problems as separation and divorce, homicide, alcohol consumption, rape and robbery have also been found to increase in a westerly direction (15), the findings of this study are consistent with earlier research. It should be pointed out, however, that this westerly trend is affected by gender. Except for 1981, the greater westerly suicide rates for males was relatively consistent, whereas for females, Ontario and the Prairies were reversed. For both males and females it was found that suicide rates in Quebec increased rather dramatically, while the rates in other provinces levelled off or declined. More detailed analysis of these regional differences as they relate to gender and to other social issues such as migration patterns, "boom/bust" economic phenomena, political situation and changing value structures is required in order to come to a better understanding of these findings.

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